DOCUMENT RESUME

ED 345 033 CE 061 118

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TITLE Educational Reform: Bridging the Tech Prep Gap.
PUB DATE Dec 91
NOTE 28p.; Paper presented at the American Vocational Association Convention (Los Angeles, CA, December 1991).
PUB TYPE Speeches/Conference Papers (150) -- Viewpoints (Opinion/Position Papers, Essays, etc.) (120)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Associate Degrees; Basic Skills; *College Programs; Competence; Competency Based Education; *Developmental Programs; *Educationally Disadvantaged; *Educational Needs; Education Work Relationship; Postsecondary Education; *Technical Education; Technology; Transitional Programs; Two Year Colleges
IDENTIFIERS *Northern Michigan University; Tech Prep

ABSTRACT

In response to the Perkins Vocational and Applied Technology Act, schools and colleges across the country are rushing to launch "tech prep" education programs. The resulting 2 + 2 programs are designed primarily for 16- to 20-year-olds who complete high school and then go on for postsecondary education in a technical or practical field. However, the legislation does not take into account that segment of the out-of-school population who also desire to earn an associate degree in a practical field but are inadequately prepared to do so. In an effort to bridge the knowledge gap of this group, the School of Technology and Applied Sciences at Northern Michigan University began a 1-semester, technology-oriented developmental program. The bridging curriculum addresses all the competencies recommended for technical preparation by the Michigan Tech-Prep Task Force in order to strengthen the learners' basic skills. Major components of the program include assessment, counseling, advising, faculty inservice training, course delivery, program evaluation, and follow-up. The interdisciplinary curriculum requires students to attend classes for 30 hours per week. Courses include survival skills, applied communications, applied mathematics, principles of technology, applied chemistry and biology, computer literacy, the systems approach, modern technology, quality, entrepreneurship, inventing, and career planning. The program provides students experiences comparable to those of "tech prep" students and allows them to enroll in an associate degree program with expectations of success. (14 references) (Author/KC)

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EDUCATIONAL REFORM: BRIDGING THE TECH PREP GAP

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EDUCATIONAL REFORM: BRIDGING THE TECH PREP GAP

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ABSTRACT

In response to the Perkins Vocational and Applied Technology Act schools and colleges across the country are rushing forth to launch Tech Prep education programs. The resulting 2 + 2 programs are designed primarily to address a 16 to 20 year old population who complete high school and then go on for post-secondary education in a technical or practical field. However, the legislation does not take into account that segment of our out of school population who also desire to earn an associate degree in a practical field but are inadequately prepared to do so. Information presented addresses a technical foundation or bridging program which provides the student with a background comparable to that recommended for high school students who would complete the first two years of a Tech Prep program.

INTRODUCTION

After a successful military campaign in the Middle East the United States finds itself battling another war. This war has our nation fighting to remain competitive in a global labor market. An overriding concern for the strategist of this battle is the impending depletion of a vital resource, skilled people (Roth, 1991). In many areas of our country, a primary economic concern is no longer finding enough jobs for people, but finding people who have the skills for the new jobs (Vaughan, 1991). The gap between the skills of our labor force and the needs of business and industry is slowly eroding the economic stature of the United States.

THE PROBLEM

The National Center on Education and the Economy identified part of the problem in their report entitled America's Choice: High Skills or Low Wages (1990). The report suggests that the United States has the worst school-to-work transition system for young people of all industrialized nations. In his interpretation of the report Sculley (1991) wrote, "we can choose to

develop a technologically competent work force that will guarantee the quality of life for us and future generations, or we can choose to become a second-rate country that supplies the rest of the world with low-skilled and low-paid workers." Major changes are called for in the way we prepare and train people for work. If changes are not implemented we may be destined for the second choice.

Of immediate concern to many of this country's leaders is the need to bolster the skills of young people in the 16 to 24 age group (Roth, 1991). Our current educational system in the United States does not adequately prepare young people to function in today's technologically sophisticated workplace. Neither traditional general education nor traditional vocational education prepare youth to make a school to work transition (Grover, 1991).

A DIRECTION

A U.S. Department of Labor document entitled, What Work Requires of Schools: A SCANS Report for America 2000, (1991), stresses that, "all young Americans should

leave school with the know-how they need to make their way in the world" (p. vi). SCANS research verifies what is called workplace know-how. This know-how has two elements: a foundation and competencies. A three-part foundation of skills and personal qualities and five competencies have been identified as the "heart of job performance." These eight requirements are deemed essential preparation for all students, whether they plan on going directly to work or continuing their education. The foundation and competencies should be taught and understood in an integrated fashion reflecting the workplace contexts in which they are applied (p. xvi).

SCANS Five Competencies

Resources: Identifies, organizes, plans, and allocates resources
A. *Time*
B. *Money*
C. *Material and Facilities*
D. *Human Resources*

Interpersonal: Works with others
A. *Participates as Member of a Team*
B. *Teaches Others New Skills*
C. *Services Clients/Customers*
D. *Exercises Leadership*
E. *Negotiates*
F. *Works with Diversity*

Information: Acquires and uses information
A. *Acquires and Evaluates Information*

B. *Organizes and Maintains Information*
C. *Interprets and Communicates Information*
D. *Uses Computers to Process Information*

Systems: Understands complex inter-relationships
A. *Understands Systems*
B. *Monitors and Corrects Performance*
C. *Improves or Designs Systems*

Technology: Works with a variety of technologies
A. *Selects Technology*
B. *Applies Technology to Task*
C. *Maintains and Troubleshoots Equipment*

The five SCANS competencies eliminate the gap between school and workplace. In that these competencies are required in any workplace dedicated to excellence, they reflect the quality of today's expert worker. And they [are the essence] behind the quality of every product and service offered [in] today's market (p. xvi).

SCANS Three-Part Foundation

Basic Skills: Reads, writes, performs arithmetic and mathematical operations, listens, and speaks
A. *Reading*
B. *Writing*
C. *Arithmetic/Mathematics*
D. *Listening*
E. *Speaking*

Thinking Skills: Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons
A. *Creative Thinking*
B. *Decision Making*
C. *Problem Solving*
D. *Seeing Things in the Mind's Eye*
E. *Knowing How to Learn*
F. *Reasoning*

Personal Qualities:Displays responsibilities, self-esteem, sociability, self-management, and integrity and honesty

A. *Responsibility*
B. *Self-Esteem*
C. *Sociability*
D. *Self-Management*
E. *Integrity/Honesty*

Educators must revise the purpose and mission of education in the United States. The needed educational reform must begin by stopping the practice of conducting education as if there were two worlds (Hoerner, 1991). Former U.S. Secretary of Labor, Willard Wertz summed it up when he said, "there aren't two worlds - education and work, there is one world - life. Learning by hands-on participation ... should be at the heart of our educational perspective." (W.T. Grant Foundation, 1988). Educators have kept alive the myth, first there is education, then later on, out there someplace is the world of work (Hoerner, 1991).

Considerable attention has been devoted to education and workforce development. Johnson and Packer (1987) in Workforce 2000 claimed that education and training are the primary systems by which the human capital of a nation is preserved and increased. McLaughlin,

Bennett, and Verity (1988) in their report Building a Quality Workforce promoted education in preparing people for work by stating, "Education has the primary responsibility for initially preparing the entry level workforce." The study, America's Choice: High Skills or Low Wages, emphasizes the education work relationship in the statement: "Guaranteeing the right to a good education to every young American and providing positive links between educational achievement and jobs are essential to the creation of an educated nation." (Commission on Skills of the American Workforce, 1991, p. 72)

With all of the attention directed to education and workforce development it can readily be seen that the American system of education is in need of reform. Fiske (1991) in Smart Schools, Smart Kids addresses this needed educational reform and the new role for educators. He states, "The consequences of becoming a learning society are enormous, for it means that for the first time schools have been given the job of producing the capital on which the country depends" (p. 23). If schools are truly going to assist our country

in maintaining its position as a leader in a global society then all educators, teachers, counselors, and administrators alike must philosophically commit to educational reform. We can no longer continue to operate an educational system that, "sorts out the best and forgets the rest" (Hart, 1989).

NEW MISSION

The mission of education should now be about "success schools" (Hart, 1989, p. 239) and schools that are "learning oriented, not teacher oriented" (Fiske, 1991, p. 66). Education must be relevant to the learner. "Learning takes place when learners regard what one needs to know as relevant to their lives" (W.T. Grant Foundation, 1988). America's Choice supports the importance of relevancy by stating, "the lack of any clear direct connection between education and employment opportunities for most young people is one of the most devastating aspects of the existing system." (Commission on Skills of the American Workforce, 1990, p. 72). Secretary of Labor, Lynn Martin claims, "schools must teach with work in mind - "contextual learning" as it is called" (Secretary's

Commission on Achieving Necessary Skills, 1991, June). The new mission for education then, as Hoerner reasons, "is to develop an educational system that has as its major thrust: to prepare all students for further and productive employment" (1991).

Tech Prep Education programs provide a pathway through which the new mission for education can be accomplished. Simply stated, "Tech Prep education is a combined high school-postsecondary program which leads to an associate degree or certificate, provides technical preparation in at least one mechanical, engineering, industrial, or practical field, provides a high level of competence in mathematics, science and communication, and leads to productive employment" (Ford, 1991). Graduates of Tech Prep programs will have been exposed to occupational and academic learning experiences that will provide them with the capacity to change and grow in the workplace.

MICHIGAN'S EFFORT

Tech Prep has been referred to as one of the most exciting initiatives in education in decades (Hull and

Parnell, 1991). Michigan's State Board of Education quickly reorganized the potential of Tech Prep education in workforce development. A Tech Prep Task Force was established and charged with developing a series of recommendations that could be used as guidelines for program development.

Recommendations of the Task Force address the findings of cognitive science, that the teaching of skills is best accomplished through contextual learning. The results of the Task Force support the three principles from cognitive science suggested, by the Secretary's Commission on Achieving Necessary Skills (1991, June), to guide real contextual learning in all our schools.

1. Students do not need to learn basic skills before they learn problem-solving skills. The two go together. They are not sequential but mutually reinforcing;
2. Learning should be reoriented away from mere mastery of information and toward encouraging students to recognize and solve problems; and
3. Real know-how (foundation and competencies) cannot be taught in isolation; students need practice in the application of these skills (p. 19).

One significant recommendation of the Tech Prep Task Force (1988) called for the development of a technical core curriculum that would provide learning experiences

in the following four areas.

1. Abstract Thinking: The development of reasoning, problem solving, and decision making skills. These skills should be developed in all courses.
2. Attitudinal Development: The development of social and work skills which include interpersonal skills, adaptability, accountability, employability, entrepreneurship, and work ethics.
3. Technical Literacy: The development of computer literacy as well as other technical skills relevant to a particular program.
4. Technology Education: The development of insights into technology, understanding its significance, and assessing its social and cultural impact.

To support the learning experiences identified the Task Force developed specific technical preparation competencies for abstract thinking and attitudinal development. Abstract thinking competencies address reasoning, problem solving, and decision making. The learner should demonstrate the ability to:

1. Gather and interrelate facts, identify, conceptualize and recognize problem implications and significance, and analytically resolve problems and decisions.
2. Recognize inconsistencies in the way things are and the way they should be; initiate problems solving techniques to resolve situations.
3. Distinguish among facts, assumptions, and opinions.
4. Use inductive and deductive reasoning to trouble shoot and diagnose technical problems.
5. Use decision making tools (i.e. risk/benefit

criteria) to break problems down into manageable proportions.
6. Relate knowledge, experience, and principles to new situations.
7. Change behaviors.
8. Develop, evaluate, and adopt logical steps to implement decisions (p. 4).

These abilities should be developed in all course work especially in mathematics, science, communications, and in technical course areas.

Attitudinal development stresses interpersonal adaptability, employability, entrepreneurship, and work ethic competencies. The student should demonstrate the ability to:

1. Develop good working relationships with superiors and co-workers in an occupational role; demonstrate appropriate workplace behaviors; understand the value and function of courtesy, compassion, fairness, humor, and positive attitude in human relationships; deal with conflict or criticism in a rational, productive manner; understand and participate in the team concept; understand the basis for thoughts, feelings, and behavioral styles, and interact accordingly; recognize social and cultural implications and follow accepted societal rules.
2. Adjust to change in schedules, assignments, procedures, personnel, and policies; continue learning and job training to improve and enhance existing skills and to learn new skills.
3. Complete procedures necessary to obtain employment; identify personal and technical skills and abilities; understand the

principles of competition, cooperation, and leadership in a work environment; understand compensation principles.

4. Understand how a business is organized and capitalized, understand competition and its impact on productivity, profitability, and risk; understand the need for structure and organization in an enterprise; understand the role of research and development in technological occupations; understand accountability for results; understand that progress in technology is a function of initiative, innovation, and trail-and-error experimentation; understand that failure and success are regarded as an essential ingredient in progress.
5. Accomplish assigned tasks with or without supervision; demonstrate ingenuity in meeting challenges; take pride in quality craftsmanship or service; exercise initiative; accept and seek out responsibility; keep tools, machines, and work stations in good order; distinguish between what belongs to the organization and what belongs to the person; maintain dependable attendance and punctuality; maintain standards of appearance and personal hygiene; understand the meaning of "work" and the significance of "a day's work for a day's pay" (p. 5).

The Michigan State Board of Education, upon accepting the recommendations of the Tech Prep Task Force, also approved specific competencies that the student should acquire in mathematics, science, and communication courses.

1. **MATHEMATICS** - The student should demonstrate an ability to calculate through the level of ratios, proportions, and percentages; to support ideas quantitatively; to estimate; to

use division, multiplication, addition, and subtraction with real numbers, decimals, fractions, integers, roots, and powers; to calculate distance, weight, area, volume, and time; to use the metric system and to convert between metrics and traditional systems; to read and to create charts, tables, and graphs; to apply mathematics in the solution of economic and technical problems.

2. **SCIENCE** - The student should demonstrate the ability to recognize medical, physical, chemical, and biological problems and solve selected problems through the application of basic scientific principles.
3. **COMMUNICATION** - The student should demonstrate the ability to read, comprehend and interpret written directions, technical publications, reports, policies and procedures, diagrams and charts. Demonstrate an ability to ask and answer questions coherently to obtain clarity, and verify information; conceive, develop, and organize ideas about a subject and present them clearly in standard oral English; present oral reports succinctly; take part in and interpret the exchange of ideas in discussions (p. 4).

THE NEGLECTED

Our country's leaders have expressed a need to "bolster the skills ... of the ... 16 to 24 age group". Tech Prep 2 + 2 programs are designed to address the 16 to 20 age group and should do so most effectively. Representative William D. Ford of Michigan, when introducing H.R. 5290, the "Tech Prep Education Act", stated "tech prep education will clearly contribute to lowering the unemployment rate" (Ford, 1991). If Tech

Prep is to really contribute to lowering the unemployment rate postsecondary education must address the needs of those not having the benefit of the secondary tech prep experience. This group is comprised of high school dropouts, graduates with limited skills, displaced homemakers, immigrants, etc. Their numbers are significant and they desire training that will allow them the same opportunities of finding employment beyond the entry level. Because of age and other circumstances it is not possible for these people to participate in a secondary tech prep program.

In an effort to bridge the knowledge gap of the inadequately prepared, out of school population desiring to earn an associate degree in a technical or practical field, the School of Technology and Applied Sciences at Northern Michigan University initiated the establishment of a technology oriented developmental program. The program was designed to provide learning experiences comparable to those afforded high school tech prep students. Curriculum addressed the Technical Preparation Competencies recommended by the Michigan State Board of Education, Tech Prep Task Force.

Requirements also stipulated that the program be no more than one semester in length.

PROGRAM DEVELOPMENT

The bridging program curriculum presented addresses all of the competencies recommended for technical preparation by the Michigan Tech-Prep Task Force. As such, the model is easily adaptable to any community college desiring to offer similar learning experiences. Ideally, faculty participating in the program should be provided with an inservice program directed to "Teaching for Critical Thinking" prior to initiating the tech-prep program. If students are to be successful in their pursuit of an associate degree and future career, they must learn to read, write, speak, and view critically (Paul, 1990).

PROGRAM PLAN

The goal of the program is to strengthen the learner's foundation of general skills; those basic skills necessary to successfully complete a technology related associate degree. Major components of the program include assessment, counseling, advisement, faculty

inservice, course delivery, program evaluation, and follow-up.

Persons interested in the program are required to participate in a pre-enrollment assessment. The purpose of the assessment is to determine areas of interest, general aptitudes, reasoning skills, mathematics, and reading levels. Applicants with mathematics and reading levels below the eighth grade are counseled into specific remediation programs.

Counselors meet with applicants and discuss their academic strengths and weaknesses. Suggestions are provided relative to technical program choices. Potential program candidates are then assisted in planning course schedules. Financial aid and other concerns are also addressed at this time.

Faculty teaching in the program should participate in a Teaching for Critical Thinking inservice workshop. The purpose of the workshop is to expose faculty to methods of incorporating critical thinking into and across the curriculum. Methods and strategies for teaching higher

order thinking, writing, listening, speaking, and viewing skills are stressed. The development of technological literacy, higher order thinking skills, and positive social and work attitudes is the binding force of the curriculum.

The design of the integrated curriculum was based on Fogarty's Integrated Model. Fogarty (1991) defines the Integrated Model of curriculum design as "an interdisciplinary approach matching subjects for overlaps in topics and concepts with some team teaching in an authentic integrated model."

Evaluation is a major factor in the success of any program. An assessment of students, faculty, course content, delivery systems, auxiliary services, support services, and financial resources must be conducted if a program is to grow and prosper. Evaluation results provide information for program improvement and strategic planning.

Follow-up studies provide valuable information when assessing program effectiveness. Program modifications

and improvements can be implemented if there is a rationale for the action. Initial follow-up activities are directed to determining overall effectiveness and curriculum appropriateness. How well students who complete the program do in their associate degree studies and on-the-job is the true measure of success or failure of the program.

THE CURRICULUM

The one semester program requires students to attend class for a total of 470 clock hours over a fifteen week period (approximately 30 hours per week). Courses are scheduled in blocks; three blocks of 20 days and one of fifteen. Fifteen semester hours of credit should be awarded for satisfactory completion of all course requirements.

TECH FOUNDATIONS

Course Title	Clock Hours
Survival Skills	20
Applied Communications	40
Applied Mathematics	60
Principles of Technology or Applied Chemistry/Biology	60
Computer Literacy	40
The Systems Approach	40
Modern Technology	40

Quality	40
Entrepreneurship	40
Inventing	60
Career Planning	30
TOTAL	470

COURSE DESCRIPTIONS

SURVIVAL SKILLS

A course designed to assess and enhance individual learning styles, identify support systems, and networks available to students, and upgrade study skills.

APPLIED COMMUNICATIONS

A practical learning experience designed to strengthen communication skills by integrating reading, writing, listening, and speaking activities in a simulated workplace environment.

APPLIED MATHEMATICS

An integrated presentation of topics in arithmetic, algebra, geometry, trigonometry, probability, estimation, and problem solving. Course materials are oriented toward the application and practice of mathematical concepts and skills in solving work related problems.

PRINCIPLES OF TECHNOLOGY

A practical course in applied physics dealing with concepts in basic mechanical, fluid, electrical, and thermal energy systems. Course content, oriented toward contemporary technology, is addressed through discussions, video presentations, readings, math "problem solving" labs, and hands-on physics labs. The development of technological literacy and problem solving skills are stressed.

APPLIED CHEMISTRY/BIOLOGY

A practical course integrating biology and chemistry principles into a single interdisciplinary whole. Subject matter addresses science concepts in terms of applications. Emphasis is placed on occupationally relevant hands-on problem solving activities.

COMPUTER LITERACY

A practical learning experience designed to explain the significance and role of the computer in society. Course work addresses understanding introductory concepts of computer hardware,

software, and operations. Simple programming and microcomputer applications are included.

THE SYSTEMS APPROACH

A practical approach, integrating technological literacy, to understanding and utilizing information systems to resolve problems.

MODERN TECHNOLOGY

A course designed to address the development of technology and promote technological literacy by tracing the evolution of man as a user of tools and the impact these tools have had on his intellectual and social development.

QUALITY

A course designed to acquaint the learner with basic quality control and problem solving techniques. Conformance to applicable specifications and standards, fitness for use, satisfaction of customer wants, needs and expectations at a competitive cost are addressed utilizing the quality circles concepts.

ENTREPRENEURSHIP

An examination of the concepts, strategies, and applications involved in entrepreneurship. Content addresses a profile of entreprenurs along with the risks and rewards, creating products and services for the marketplace, going into business - start up, legal and financial aspects - buy out or franchise.

INVENTING

A capstone problem solving experience designed to identify and develop new and unique technics which can be used to expand human potential.

CAREER PLANNING

Designed to assist students in identifying and refining career choices, evaluating sources of education or training, securing admission and financial aid and developing a personal plan for attaining their desired career goal.

COURSE SCHEDULING PLAN

BLOCK 1	BLOCK 2	BLOCK 3	BLOCK 4
SURVIVAL SKILLS	COMPUTER LITERACY	MODERN TECHNOLOGY	INVENTING
1 hr/day 20 days 20 hours	2 hr/day 20 days 40 hours	2 hr/day 20 days 40 hours	4 hr/day 15 days 60 hours
APPLIED COMMUNICATIONS	SYSTEMS APPROACH	QUALITY	
2 hr/day 40 hours	2 hr/day 40 hours	2 hr/day 40 hours	
APPLIED MATHEMATICS	PRINCIPLES OF TECHNOLOGY OR APPLIED BIOLOGY/CHEMISTRY	ENTREPRE-NEURSHIP	CAREER PLANNING
3 hr/day 60 hours	3 hr/day 20 hours	2 hr/day 40 hours	2 hr/day 30 hours

CONCLUSION

The development of a quality workforce is essential if the United States hopes to continue to maintain its prominence and economic power in the global community. Skilled people can be developed to fill labor market needs. However, employers require more than technical skills from their future employees, they must be able to think critically and problem solve, utilize resources effectively, work with others, acquire and use

information, understand complex inter-relationships, work with a variety of technologies, communicate effectively, and be responsible, honest, and self controlled.

Responsibility for preparing the new workforce falls on our educational system. If the system is to be of any help in national workforce development major reforms must be implemented. The reforms needed require educators to change their thinking about school and work and how teaching and learning should be addressed.

Tech Prep education programs provide a pathway for preparing the kinds of skilled employees our nation needs. We can not however, afford to forsake that significant segment of our population who also desire technical education but are inadequately prepared to pursue such an experience. This group will have the greatest impact on the labor supply.

The Tech Foundations program discussed addresses the needs of the out of high school population desiring technical or practical training. As presented, the program provides enrollees the opportunity to secure, in

one semester, experiences comparable to those Tech Prep secondary students would get in their two year program. Upon completion of the Tech Foundations curriculum students can enroll in an associate degree program knowing that they can successfully compete with what will be the traditional 2 + 2 tech prep student.

America can win the global labor market war but our educators must revise their thinking about education and the workplace. Programs must also be available for all persons capable and interested in contributing to our nations efforts to remain an economic and technological power in the global society.

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